

WHAT IS CLAIMED IS:

- 1        1. A process for the oxidation of an olefin  
2                comprising three or more carbon atoms, wherein the  
3                process comprises:  
  
4                reacting the olefin with oxygen to form a  
5                reaction mixture in the presence of a catalyst  
6                composition comprising:  
  
7                silver; and,  
  
8                a promoter comprising potassium and a promoter  
9                comprising rhenium  
  
10          deposited on an  $\alpha$ -alumina carrier, wherein the  
11         potassium promoter provides potassium at a  
12         concentration of up to 120  $\mu$ mole per gram of  
13         catalyst composition.
- 1        2. The process of claim 1, wherein the potassium  
2                promoter provides potassium at a concentration of  
3                from 12  $\mu$ mole to 100  $\mu$ mole per gram of catalyst  
4                composition and the rhenium promoter provides  
5                rhenium at a concentration of from 3  $\mu$ mole to 20  
6                 $\mu$ mole per gram of catalyst composition.
- 1        3. The process of claim 2, wherein the  $\alpha$ -alumina  
2                carrier has a BET surface area of 0.1  $\text{m}^2/\text{g}$  to 25  
3                 $\text{m}^2/\text{g}$ , and an apparent porosity of from 0.1 ml/g to  
4                1.2 ml/g.

1       4. The process of claim 1, wherein the  $\alpha$ -alumina  
2           carrier comprises at least 60 %w  $\alpha$ -alumina.

1       5. The process of claim 1, wherein the  $\alpha$ -alumina  
2           carrier has a pore size distribution such that the  
3           pores with diameters in the range of from 0.2  $\mu\text{m}$   
4           to 10  $\mu\text{m}$  comprise more than 75 % of the total pore  
5           volume; the pores with diameters greater than 10  
6            $\mu\text{m}$  comprise less than 20 % of the total pore  
7           volume; and the pores with diameters less than 0.2  
8            $\mu\text{m}$  comprise less than 10 % of the total pore  
9           volume.

1       6. The process of claim 1, wherein the  $\alpha$ -alumina  
2           carrier has a water absorption of at least 0.35  
3           ml/g and a surface area in the range of from 1.0  
4            $\text{m}^2/\text{g}$  to 5  $\text{m}^2/\text{g}$ .

1       7. The process of claim 1, wherein the  $\alpha$ -alumina  
2           carrier is based on:

3           (a) from 50 %w to 90 %w of a first particulate  $\alpha$ -  
4           alumina having an average particle size of from  
5           more than 10  $\mu\text{m}$  up to 100  $\mu\text{m}$ ; and,

6           (b) from 10 %w to 50 %w of a second particulate  $\alpha$ -  
7           alumina having an average particle size of from 1  
8            $\mu\text{m}$  to 10  $\mu\text{m}$ ; said %w being based on the total  
9           weight of  $\alpha$ -alumina in the mixture.

1       8. The process of claim 1, wherein the  $\alpha$ -alumina carrier  
2 comprises:

3             (a) from 65 %w to 75 %w, relative to the total  
4 weight of  $\alpha$ -alumina in the mixture, of a first  
5 particulate  $\alpha$ -alumina having an average particle size of  
6 from 11  $\mu\text{m}$  to 60  $\mu\text{m}$ ;

7             (b) from 25 %w to 35 %w, relative to the total  
8 weight of  $\alpha$ -alumina in the mixture, of a second  
9 particulate  $\alpha$ -alumina having an average particle size of  
10 from 2  $\mu\text{m}$  to 6  $\mu\text{m}$ ;

11            (c) from 2 %w to 5 %w of an alumina hydrate,  
12 calculated as aluminum oxide relative to the total weight  
13 of  $\alpha$ -alumina in the mixture;

14            (d) from 0.2 %w to 0.8 %w of an amorphous silica  
15 compound, calculated as silicium oxide relative to the  
16 total weight of  $\alpha$ -alumina in the mixture; and,

17            (e) from 0.05%w to 0.3 %w of an alkali metal  
18 compound, calculated as the alkali metal oxide relative  
19 to the total weight of  $\alpha$ -alumina in the mixture.

1       9. The process of claim 1 wherein the reaction  
2 mixture further comprises an organic chloride promoter.

1       10. The process of claim 9 wherein the organic  
2 chloride is present at a concentration of at least 50 ppm  
3 by volume.

1           11. The process of claim 9, wherein the reaction  
2 mixture further comprises a NO<sub>x</sub> promoter, wherein x is 1  
3 or 2.

1           12. The process of claim 9, wherein the NO<sub>x</sub> promoter  
2 is present at a concentration of at least 10 ppm by  
3 volume.

1           13. A catalyst composition for the oxidation of an  
2 olefin comprising three or more carbon atoms,  
3 wherein the catalyst composition comprises:

4           silver; and,

5           a promoter comprising potassium and a promoter  
6 comprising rhenium

7           deposited on an  $\alpha$ -alumina carrier, wherein the  
8 potassium promoter provides potassium at a  
9 concentration of from 8  $\mu$ mole to 120  $\mu$ mole per  
10 gram of catalyst composition.

1           14. The catalyst of claim 13, wherein the rhenium  
2 promoter provides rhenium at a concentration of from  
3 1  $\mu$ mole to 30  $\mu$ mole per gram of catalyst  
4 composition.

1           15. The catalyst of claim 13, wherein the carrier  
2 comprises an  $\alpha$ -alumina carrier is based on:

3           (a) from 50 %w to 90 %w of a first particulate  $\alpha$ -  
4 alumina having an average particle size of from more than  
5 10 up to 100  $\mu$ m; and,

6               (b) from about 10 %w to about 50 %w of a second  
7 particulate  $\alpha$ -alumina having an average particle size of  
8 from 1  $\mu\text{m}$  to 10  $\mu\text{m}$ ; and wherein said %w is based on the  
9 total weight of  $\alpha$ -alumina in the mixture.

1               16. The catalyst of claim 13, wherein  $\alpha$ -alumina  
2 carrier has a pore size distribution such that pores with  
3 diameters in the range of from 0.2  $\mu\text{m}$  to 10  $\mu\text{m}$  represent  
4 more than 75 % of the total pore volume; pores with  
5 diameters greater than 10  $\mu\text{m}$  represent less than 20 % of  
6 the total pore volume; and pores with diameters less than  
7 0.2  $\mu\text{m}$  represent less than 10 % of the total pore volume.

1               17. The catalyst composition of claim 13, wherein  
2 the  $\alpha$ -alumina carrier has a water absorption of at least  
3 0.35 ml/g and a surface area in the range of from 0.6  $\text{m}^2/\text{g}$   
4 to 5  $\text{m}^2/\text{g}$ .

1               18. The catalyst of claim 13, wherein the carrier  
2 comprises an  $\alpha$ -alumina carrier having a composition  
3 comprising:

4               (a) from 65 %w to 75 %w, relative to the total  
5 weight of  $\alpha$ -alumina in the mixture, of a first  
6 particulate  $\alpha$ -alumina having an average particle size of  
7 from 11  $\mu\text{m}$  to 60  $\mu\text{m}$ ;

8               (b) from 25 %w to 35 %w, relative to the total  
9 weight of  $\alpha$ -alumina in the mixture, of a second  
10 particulate  $\alpha$ -alumina having an average particle size of  
11 from 2  $\mu\text{m}$  to 6  $\mu\text{m}$ ;

12           (c) from 2 %w to 5 %w of an alumina hydrate,  
13 calculated as aluminum oxide relative to the total weight  
14 of  $\alpha$ -alumina in the mixture;

15           (d) from 0.2 %w to 0.8 %w of an amorphous silica  
16 compound, calculated as silicium oxide relative to the  
17 total weight of  $\alpha$ -alumina in the mixture; and

18           (e) from 0.05 to 0.3 %w of an alkali metal compound,  
19 calculated as the alkali metal oxide relative to the  
20 total weight of  $\alpha$ -alumina in the mixture.